

THE VASCULAR FLORA OF PUNTA BANDA, BAJA CALIFORNIA NORTE, MEXICO

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ABSTRACT

Punta Banda, a peninsula 24 km south of Ensenada, northwestern Baja California Norte, Mexico, has a flora of 258 species, 208 of which are native. This report includes an annotated checklist of the species with a description of the vegetation, physical environment, and a brief discussion of floristic and biogeographic considerations.

Species richness on Punta Banda is roughly comparable with that on the California Channel Islands. The treeless, shrubby vegetation, characteristic of coastal areas in northwestern Baja California, is marked by the conspicuous presence of succulent species (*Agave shawii*, *Dudleya brittonii*, six genera of cacti) in appropriate situations, particularly in steep or rocky areas and on slopes with a southerly exposure.

Typical chaparral-coastal sage scrub taxa make up about half of the native flora with another 15 percent of the species endemic to the coastal sage scrub-chaparral transition zone centered in northwestern Baja California. About 11 percent of the native flora are desert taxa and about 17 percent are widespread Pacific Coast taxa. Two species (*Dudleya campanulata* and *Astragalus sanctorum*) are endemic to the peninsula and four species (*Eriogonum grande*, *Dudleya anomala*, *Hemizonia greeneana* ssp. *peninsularis*, and *Ribes viburnifolium*) represent limited mainland occurrences of otherwise insular taxa.

Punta Banda, 15 km south of Ensenada (Baja California Norte, Mexico), has attracted botanists for many years with its spectacular topography and rich flora. To date, however, no biogeographical or ecological studies have described the flora and vegetation of this peninsula. This paper, the first in a series, gives a brief introduction to the geographic characteristics and vegetation of the peninsula and provides an annotated checklist of the vascular plants.

PHYSICAL GEOGRAPHY

Geographically, Punta Banda represents a seaward extension of Punta Banda Ridge, a range of hills continuing eastward toward Santo Tomas (Fig. 1). The peninsula itself is approximately 13 km in length and varies from 2 to 3 km in width. The steep backbone of the peninsula reaches a maximum height of 400 m at Banda Peak (Pico Banda) near its tip. East of the peninsula, Punta Banda Ridge reaches 1100 m. Recent uplift has produced steep cliffs around most of the coast of the peninsula, with vertical escarpments of 20–60 m in most areas. A long sand spit, Playa de Punta Banda, extends northeast from near the



FIG. 1. Punta Banda, Baja California Norte. Topography and place names. The heavy dashed lines indicate the approximate boundaries of the area covered.

base of the peninsula toward Ensenada, providing the only really sandy beaches. A larger estuary, Estero de Punta Banda, separates this sand spit from the mainland.

Geologically, the majority of the peninsula is composed of Lower Cretaceous (Albian) metamorphic rocks as is Punta Banda Ridge to the east. Massive formations of andesite porphyry form prominent sea bluffs and hills on the south side from La Bufadora northwestward

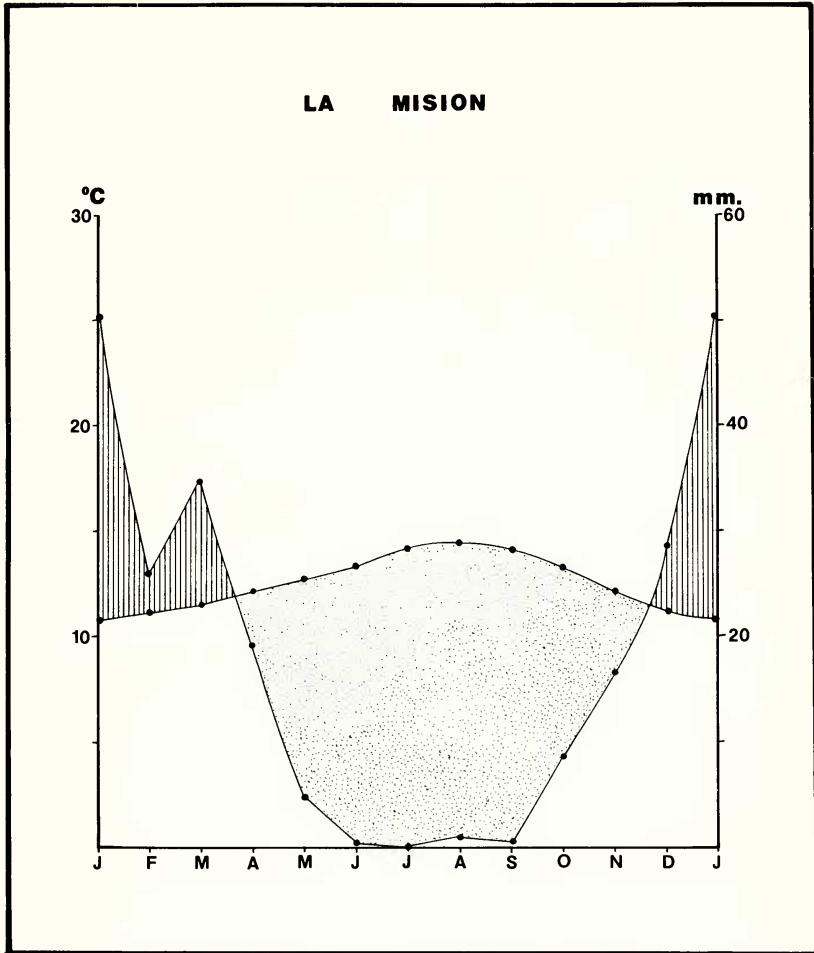


FIG. 2. Monthly climatic pattern of mean temperature ($^{\circ}\text{C}$) and precipitation (mm) at La Misión, Baja California. Data for 18-year record ending in 1965 from Hastings and Humphrey (1969).

toward the tip. However, the north-central part contains a 5 km² exposure of Upper Cretaceous (Maestrichtian) sedimentary rock (Allen et al., 1961). Much of the contact between these two formations is part of the Agua Blanca fault system (Allen et al., 1961). Right-lateral strike-slip fault movement of this system along the northern flanks of Punta Banda has produced the peninsula's gross outline.

Quaternary marine deposits cover many local slopes on the peninsula to depths up to 30 m (Orme, 1972). Irregular tectonic uplift of these deposits through the Quaternary has resulted today in at least 13 levels of marine terraces, the highest at 345 m. Terraces are present

on all parts of Punta Banda but are best developed on the steeply dipping Upper Cretaceous sediments (Orme, 1972). Steep sea cliffs below these terraces are richly fossiliferous (Allen et al., 1961). The extensive development of terraces on Punta Banda is unique on the northwest coast of Baja California but they are comparable with the complex series of marine terraces occurring on San Clemente Island. The San Clemente terraces, formed on a submarine escarpment, are presumed to reflect the northwestward continuation of the Agua Blanca fault system (Orme, 1972).

Climatic data are not available for Punta Banda. Although extensive climatic records are available for Ensenada, the mesoclimatic regimes of the two areas are totally different. Cold water upwelling on the southern side of the peninsula contacts warmer coastal waters near the tip, producing frequent marine fogs. Often these fogs are extremely local, confined to Banda Peak and Isla Todos Santos or to the southern side of the peninsula. The ecological significance of moisture input as fog has not been investigated, but may have considerable local importance.

Mean annual precipitation at Isla Todos Santos (22 m elevation), a site comparable with Punta Banda, was 256 mm from 1933 to 1939. Over the same period Ensenada (24 m elevation) had a mean of 296 mm (Hastings, 1964), close to the 57-year mean of 280 mm (Hastings and Humphrey, 1969). Despite its proximity, summer temperatures at Ensenada are significantly higher than at Punta Banda owing to the lack of fog influence and the protection from strong winds. The most comparable station to Punta Banda is La Misión, 50 km north (Fig. 2). The mean annual temperature there is 15.2°C, 1.5° lower than at Ensenada. Mean monthly temperatures are 1–2°C lower during every month of the year.

VEGETATION

Vegetation structure on Punta Banda is dominated by coastal sage scrub with low malacophyllous shrubs and a frequent admixture of succulent plants. This vegetation is part of a transitional zone between coastal sage scrub and chaparral communities of cismontane California to the north and Sonoran desert communities to the south. Shreve (1936) and Lewis and Epling (1942) discuss this transition zone. In the vegetation of Punta Banda, community structure is extremely diverse. Community patterns will be discussed in detail in a later paper. Rocky, south-facing slopes are characterized by a mixed *Eriogonum fasciculatum*–succulent scrub community of low, open growth-form. Less arid south-facing slopes are dominated by *Rhus integrifolia*, *Artemisia californica*, and *Agave shawii*. The more mesic north-facing slopes support a community dominated by large woody deciduous shrubs—*Aesculus parryi* and *Rhus integrifolia* (or *Salvia munzii*) with *Fraxinus trifoliata* or *Malosma laurina*. Less mesic sites have a coastal sage

scrub community dominated by *Artemisia californica* and *Salvia munzii*.

Virtually pure stands of both *Adenostoma fasciculatum* and *Ambrosia chenopodiifolia*, present in many areas of the peninsula, are related to substrate. *Adenostoma* is associated with very rocky, shallow soil profiles, often on ridge tops. *Ambrosia* dominates many beach terraces and gentle hillsides, apparently associated with Indian middens. Several species are restricted to sandstone substrates on the peninsula, including *Quercus dumosa*, *Helianthemum scoparium*, and *Dudleya lanceolata*.

FLORA

The vascular flora of Punta Banda, exclusive of the Playa de Punta Banda and associated sandspit and salt marsh habitats, includes 258 species in 181 genera and 58 families. Of this total, 81 percent are native. This flora is surprisingly large considering the small diversity of habitat types present on the peninsula. These types are rocky hillsides and outcrops, dry arroyos, old beach terraces, and sea bluffs. No permanent water exists on the peninsula, and salt marsh, sandy beach, and dune habitats are absent from the area covered here. Elevational ranges are too small to produce vegetational zonation except that attributable to salt spray and slope exposure. Except for disturbed areas, all communities are dominated by shrubs, with woodlands, grasslands, and riparian communities absent.

Despite the low habitat diversity of Punta Banda, floristic diversity is somewhat greater than the general pattern of diversity demonstrated for the California Channel Islands (Johnson et al., 1973). Punta Banda, with an area of 32 km², has 208 native taxa.

The ten families best represented on Punta Banda are: Asteraceae (45 total species/34 native species); Poaceae (25/14); Fabaceae (21/18); Chenopodiaceae (13/7); Brassicaceae (13/7); Scrophulariaceae (9/9); Caryophyllaceae (8/5); Hydrophyllaceae (8/8); Solanaceae (8/7); and Cactaceae (7/7). These families make up 56 percent of the native flora, 82 percent of the introduced flora, and 61 percent of the total flora. Eight genera are represented by four or more species: *Atriplex* (8); *Lupinus* (7); *Phacelia* (5); *Haplopappus* (4); and *Ribes* (4). These genera are predominantly perennials.

The biogeographic relationships of the Punta Banda flora show a broad origin of taxa, following the pattern described by Shreve (1936). Of the native flora, 50 percent are typical coastal sage and/or chaparral taxa. The second largest group, 17 percent, are wide-ranging Pacific Coast taxa, characteristic of diverse community types. Desert taxa make up 11 percent of the flora, while coastal sage-desert transition zone endemics are 15 percent of these taxa. Finally, 5 percent are widespread species typical of weedy habitats, and 1 percent are coastal bluff species extending north into California. Introduced taxa are in-

licated by an asterisk (*) in the following list. Biogeographic relationships will be discussed in detail in a later paper.

Many taxa of the Punta Banda flora are typical of the floras of one or more of the Channel Islands. Such species as *Eriogonum grande* s.l. and *Ribes viburnifolium* have a restricted distribution on the Baja California peninsula. Other taxa occur with a limited distribution on the mainland and adjacent small offshore islands but not on the larger Channel Islands (e.g., *Dudleya anomala*, *Eriogonum grande* ssp. *testudinum*, and *Hemizonia greeneana* ssp. *peninsularis*—see Moran, 1969). Two species, *Dudleya campanulata* and *Astragalus sanctorum*, are endemic to Punta Banda. Several species reported by Moran (1950) from the adjacent Isla Todos Santos have not been observed on Punta Banda. These patterns of distribution and other data suggest that the majority of insular and coastal endemics in the southern California and Baja California transition zone floras are relictual rather than more recently evolved floristic elements (see Axelrod, 1967).

Voucher specimens are deposited in IRVC. Field collections were carried out over the period 1971–1977, with multiple trips covering each month of the year. The checklist follows.

LEPIDOPHYTA

Selaginellaceae

- Selaginella bigelovii* Underw. Common on rocky slopes.
S. cinerascens A. A. Eat. Common, forming a carpet between shrubs on flats and gentle slopes. Transition-zone endemic.

PTEROPHYTA

Aspidiaceae

- Dryopteris arguta* (Kaulf.) Watt. Occasional in arroyos on seasonally moist slopes.

Polypodiaceae

- Polypodium californicum* Kaulf. Common on seasonally damp banks and slopes.

Pteridaceae

- Adiantum jordanii* K. Müll. Frequent on shaded, seasonally moist slopes.
Pellaea andromedifolia (Kaulf.) Fée var. *pubescens* D. C. Eat. Occasional on dry, rocky slopes.
Pityrogramma triangularis (Kaulf.) Maxon var. *viscosa* (Nutt. ex D. C. Eat.) Weath. Frequent in rocky places such as steep N-facing slopes and arroyo banks, occasional on drier slopes.

CONIFEROPHYTA

Ephedraceae

Ephedra californica S. Wats. Stem-photosynthetic shrub. Occasional to frequent on slopes as in rocky areas.

ANTHOPHYTA—DICOTYLEDONEAE

Aizoaceae

**Mesembryanthemum crystallinum* L. [= *Gasoul crystallinum* (L.) Rotm.]. Succulent annual. Sea bluffs and disturbed areas.

* *M. nodiflorum* L. [= *Gasoul nodiflorum* (L.) Rotm.]. Succulent annual. Uncommon on peninsula on sandy or disturbed soil.

Carpobrotus aequilaterus (Haw.) N. E. Brown (= *Mesembryanthemum chilense* Mol.). Succulent perennial. Beaches.

Anacardiaceae

Malosma laurina Nutt. ex Abrams (= *Rhus laurina* Nutt. in T. & G.). Evergreen sclerophyll shrub. Infrequent in chaparral.

Rhus integrifolia (Nutt.) Benth. & Hook. var. *integrifolia*. Evergreen sclerophyll shrub. Common in chaparral and on windswept bluffs and hillsides among shrubs of lesser stature.

Apiaceae

Apiastrum angustifolium Nutt. Annual. Grassy places.

Daucus pusillus Michx. Annual. Grassy places.

**Foeniculum vulgare* Mill. Herbaceous perennial. Along road at top of Banda Peak.

Sanicula crassicaulis Poepp. ex DC. Herbaceous perennial. Frequent in arroyos and on shaded banks.

Asteraceae

Adenothamnus validus (Bdg.) Keck. Malacophyllous subshrub. Primarily restricted to Ensenada area but occurring to 32 km south of the U.S. border. Uncommon on north-facing chaparral slopes on sandstone.

Amblyopappus pusillus H. & A. Fragrant annual. Abundant on flats and bluff tops on the coast.

Ambrosia chenopodiifolia (Benth.) Payne. Malacophyllous shrub. Common in patches in sandy or silty soils either as nearly pure stands or with *Artemisia californica*. Often on old middens or burns (cf. Meigs, 1938).

Artemisia californica Less. Malacophyllous shrub. Common dominant on gentle slopes and old beach terraces.

- Baccharis sarothroides* A. Gray. Stem-photosynthetic shrub. Occasional, sandy disturbed places.
- **Centaurea melitensis* L. Annual. Roadside weed.
- Chaenactis artemisiifolia* (Harv. & A. Gray) A. Gray. Annual. Occasional in gravelly soil.
- **Chrysanthemum coronarium* L. Annual. Garden escape at dump and roadsides near La Joya, also present near settlement at La Bufadora.
- **Conyza bonariensis* (L.) Cronq. Annual. Roadside weed.
- C. canadensis* (L.) Cronq. Annual. Roadside weed.
- Coreopsis maritima* (Nutt.) Hook. f. Herbaceous to suffrutescent perennial. Common on sea bluffs and north-facing slopes. Transition-zone and island endemic.
- **Cotula australis* (Sieber) Hook. f. Annual. Weedy.
- Encelia californica* Nutt. Malacophyllous shrub. Common on slopes with coastal sage scrub and in disturbed places.
- Eriophyllum confertiflorum* (DC.) A. Gray. Herbaceous to suffrutescent perennial. Moderately common, mostly in disturbed areas.
- Filago arizonica* A. Gray. Annual. Herbaceous vegetation; often in heavy soil.
- F. californica* Nutt. Annual. Herbaceous vegetation, often in heavy soil.
- Gnaphalium bicolor* Bioletti. Herbaceous to suffrutescent perennial. Occasional in disturbed habitats.
- G. californicum* DC. Herbaceous to suffrutescent perennial. Disturbed habitats.
- Haplopappus berberidis* A. Gray. Malacophyllous subshrub. Common in old fields with a succulent-leaved form on beach bluffs. Transition-zone endemic.
- H. orcuttii* A. Gray. Malacophyllous subshrub. Common on flats; forming hybrids with *H. berberidis*. Transition-zone endemic.
- H. palmeri* A. Gray. Malacophyllous shrub. Locally common in sandy soils, especially in wash bottoms and on the north side of the peninsula. Transition-zone endemic.
- H. venetus* (H.B.K.) Blake ssp. *oxyphyllus* (Greene) Hall. Malacophyllous subshrub common in disturbed habitats. This subspecies is a transition-zone endemic, reaching up into the montane zone of the Sierra San Pedro Martir.
- **Hedypnois cretica* (L.) Willd. Annual. Collected once on south slope between La Bufadora and Puerto Arbolitos.
- Hemizonia fasciculata* (DC.) T. & G. Annual. Common in late spring and summer on flats and gentle slopes.
- H. greeneana* Rose ssp. *peninsularis* Moran. Malacophyllous subshrub. Occasional as isolated individuals or in small populations; present on Banda Peak; south side of peninsula west of La Bufadora, and on adjacent offshore sea stacks on the south shore

near tip of the peninsula. Endemic to Todos Santos islands, Punta Banda, and west of La Misión. Banda Peak is the type locality for this subspecies.

**Heterotheca grandiflora* Nutt. Annual. Disturbed habitats, probably introduced.

**Hypochoeris glabra* L. Annual. Roadside weed.

Lasthenia californica DC. ex Lindley. Annual. In herbaceous cover and among shrubs.

L. coronaria (Nutt.) Ordnuff. Annual. Primarily on north-facing slopes.

Microseris linearifolia (DC.) Sch.-Bip. Uncommon annual occurring with grasses and other herbaceous vegetation.

Perezia microcephala (DC.) A. Gray. Herbaceous perennial. Seen only on steep north-facing slope of Banda Peak at about 150 m in openings in dense chaparral.

Perityle emoryi Torr. Annual. Rocky open places, sometimes in salt spray zone with virtually no associates.

Porophyllum gracile Benth. Herbaceous to suffrutescent perennial. Uncommon in rocky places with southern exposure.

Rafinesquia californica Nutt. Weak-stemmed annual. Frequent among shrubs, mostly on the north side of the peninsula.

Senecio californicus DC. Annual.

S. douglasii DC. Suffrutescent perennial. Uncommon on peninsula in disturbed areas.

**S. vulgaris* L. Annual. Weed.

**Sonchus asper* (L.) Garsault. Annual. Weed about old habitations and disturbed areas.

**S. oleraceus* L. Annual. Weed about old habitations such as at Los Arbolitos.

Stephanomeria diegoensis Benth. Annual. Disturbed habitats.

Stylocline gnaphalioides Nutt. Annual. Among other herbs, usually in heavy soils.

Trixis californica Kell. Malacophyllous subshrub. Frequent on south-facing slopes and rocky places.

Verbesina dissita A. Gray. Weak-stemmed malacophyllous perennial. Mostly north-facing slopes and arroyos in chaparral. Transition-zone endemic.

Viguiera laciniata A. Gray. Malacophyllous shrub. Common on slopes.

**Xanthium strumarium* L. Cosmopolitan annual weed. Disturbed sites near La Joya.

Boraginaceae

Amsinckia intermedia F. & M. Annual. On burn northeast of Los Arbolitos.

- Cryptantha intermedia* (A. Gray) Greene. Annual. Common on open slopes.
- C. micromeres* (A. Gray) Greene. Annual. Collected on north slope of peninsula below Banda Peak and on burned area northeast of Los Arbolitos.
- Pectocarya linearis* DC. var. *ferocila* I. M. Johnst. Annual. Common on grassy flats and slopes.
- Plagiobothrys californicus* (A. Gray) Greene. Annual. Frequent in open herbaceous vegetation.

Brassicaceae

- **Brassica geniculata* (Desf.) J. Ball. Herbaceous perennial weed.
- **B. tournefortii* Gouan. Annual weed.
- **Cakile maritima* Scop. Annual. Individual growing in a runnel on dirt road above 200 m. Typically found on beach dunes, as at Playa de Punta Banda.
- Capsella rubella* Reut. Annual weed.
- Cardamine californica* (Nutt.) Greene var. *californica* (= *Dentaria californica* Nutt.). Herbaceous perennial. Relatively frequent on shaded banks, often under shrubs.
- Descurainia pinnata* (Walt.) Britton ssp. *menziesii* (DC.) Detl. Annual. Common, especially in disturbed places.
- Draba cunefolia* Nutt. ex T. & G. var. *integrifolia* S. Wats. Annual.
- Lepidium nitidum* Nutt. Annual. Common.
- **Raphanus sativa* L. Annual. In fields near Los Arbolitos.
- **Sisymbrium irio* L. Annual weed, common.
- **S. orientale* L. Annual weed, common.
- Streptanthus heterophyllus* Nutt. Annual. Occasional in chaparral; mostly north-facing slopes.
- Thelypodium lasiophyllum* (H. & A.) Greene. Annual.

Buxaceae

- Simmondsia chinensis* (Link.) C. K. Schneid. Evergreen sclerophyll shrub. Frequent on south-facing slopes and in rocky places.

Cactaceae

- Bergerocactus emoryi* (Engelm.) Britt. & Rose. Succulent. Common and conspicuous on south-facing slopes and rocky habitats. Transition-zone endemic.
- Echinocereus maritimus* (M. E. Jones) K. Schum. Succulent. Frequent on south-facing slopes. Transition-zone endemic.
- Ferocactus viridescens* (Nutt.) Britt. & Rose var. *littoralis* Lindsay. Succulent. Transition-zone endemic. Common in rocky soils and also as a dwarf form 2–5 cm or less high (but with normal width of 12–20 cm) in heavy soils on windswept flats with *Selaginella*

cinerascens and *Agave*. This dwarf form is most extreme on soils derived from volcanic parent materials, as at La Misión to the north.

Machaerocereus gummosus (Engelm.) Britt. & Rose. Succulent. Infrequent but conspicuous on steep south-facing slopes, especially near ridge tops. This is near the northern limit of this taxon which is a characteristic element of the Baja California desert flora.

Mammillaria dioica K. Bdg. Succulent. Common in open vegetation; especially in rocky places on south-facing slopes.

Opuntia oricola Philbrick. Succulent. Occasional on south-facing slopes.

O. prolifera Engelm. Succulent. Occasional in open vegetation primarily on south-facing slopes. Frequently associated with Indian middens or otherwise disturbed areas.

Capparidaceae

Cleome isomeris Greene (= *Isomeris arborea* Nutt.). Malacophyllous shrub, normally evergreen. Occasional among shrubs on flats and on most slope exposures.

Caprifoliaceae

Sambucus mexicana Presl. Winter deciduous shrub to low tree. Infrequent on north side of peninsula near La Joya.

Caryophyllaceae

Cardionema ramosissimum (Weinm.) Nels. & Macbr. Herbaceous perennial. Infrequent tuft-forming plant in sandy or compacted bare soil.

Polycarpon depressum Nutt. Prostrate annual.

**P. tetraphyllum* (L.) L. Prostrate annual. Roadsides and paths.

Silene antirrhina L. Annual. Common in disturbed grassy areas.

**S. gallica* L. Annual. Weed in old fields, etc.

S. laciniata Cav. ssp. *major* Hitchc. & Maguire. Herbaceous perennial. Occasional on north-facing slopes in chaparral.

Spergularia macrotheca (Hornem.) Heynh. Herbaceous perennial. Flat area near the tip of the peninsula.

S. villosa (Pers.) Camb. Herbaceous perennial. Hard-packed soil along roadside near Tres Hermanas (Three Sisters) and near La Bufadora.

Chenopodiaceae

Aphanisma blitoides Nutt. Succulent annual. Terraces and bluffs near the ocean.

Atriplex californica Moq. in DC. Suffrutescent perennial. Apparently

uncommon. Our collections are from an offshore islet and a sea bluff on the south side of peninsula.

- Atriplex canescens* (Pursh) Nutt. ssp. *canescens*. Shrub. Uncommon; a few plants near Los Arbolitos. Occurs sporadically along the coast in this area, usually associated with old Indian encampments.
- A. coulteri* (Moq.) D. Dietr. Suffrutescent perennial. Collected twice in disturbed places on soils from sedimentary rocks. Sandstone wash area near La Joya and roadside.
- A. julacea* S. Wats. Semi-succulent shrub. Common, dry flats and gentle slopes. Transition zone and Vizcaino Region.
- **A. lentiformis* (Torr.) S. Wats. ssp. *breweri* (S. Wats.) Hall & Clem. Shrub. Roadside north side of peninsula west of La Joya. Probably introduced at this site.
- **A. lindleyi* Moq. Perennial herb. Uncommon weed in roadside depression near La Bufadora.
- A. pacifica* Nels. Annual. Sea bluffs and offshore stacks.
- **A. semibaccata* R. Br. Suffrutescent perennial. Common in disturbed areas and with native vegetation, especially in grazed areas.
- **Chenopodium album* L. Annual. Common weed.
- **C. ambrosioides* L. Annual or herbaceous perennial. Roadside weed.
- C. californicum* (S. Wats.) S. Wats. Herbaceous perennial. Common on banks and slopes in chaparral and in disturbed habitats.
- **Salsola iberica* Sennen & Pau. Annual. Weed in old fields and disturbed places; among native species in overgrazed areas.

Cistaceae

- Helianthemum scoparium* Nutt. var. *vulgare* Jeps. Stem-photosynthetic subshrub on sandstone; a small colony with *Quercus dumosa* Nutt. in canyon west of La Joya, on north side of peninsula.

Convolvulaceae

- Calystegia macrostegia* (Greene) Brummitt ssp. *longiloba* (Abrams) Brummitt. Perennial vine. Common, twining among shrubs.
- Dichondra occidentalis* House. Perennial herb. Uncommon on sandstone.

Cuscutaceae

- Cuscuta californica* H. & A. Annual parasite. Common on *Eriogonum fasciculatum*, *Haplopappus venetus*, *Salvia munzii*, etc.

Crassulaceae

- Crassula erecta* (H. & A.) Berger (= *Tillaea erecta* H. & A.). Diminutive succulent annual. Common in dry shallow soils.
- Dudleya anomala* (Davids.) Moran. Rosette succulent. Steep north-

facing beach cliffs bordering Todos Santos Bay. Known otherwise only from Todos Santos and Los Coronados Islands.

- Dudleya attenuata* (S. Wats.) Moran ssp. *orcuttii* (Rose) Moran. Rosette succulent. Common on dry slopes. Transition-zone endemic.
- D. brittonii* D. A. Johansen. Rosette succulent. Common and conspicuous in open vegetation and rocky areas on south-facing slopes. A more or less glaucous form occurs locally with the more common non-glaucous form in three areas: two populations on steep north-facing rocky slopes and a third in sand on Playa del Punta Banda. Transition-zone endemic.
- D. campanulata* Moran. Rosette succulent. Local endemic occurring only on the south side of the peninsula on large sea stacks and on igneous ridges west of La Bufadora.
- D. lanceolata* (Nutt.) Britt. & Rose. Rosette succulent. Locally common on arroyo banks. On Punta Banda, near the southern limit of the species, it appears to be restricted to sedimentary formations; elsewhere it occurs on a variety of substrata.
- D.* × *semiteres* (Rose) Moran. Rosette succulent. Apparently a recurrent natural intersubgeneric hybrid between *D. attenuata* ssp. *orcuttii* and *D. brittonii*. Infrequent; observed in several places with the putative parent species. Transition-zone and insular endemic.

Cucurbitaceae

- Marah macrocarpus* (Greene) Greene. Herbaceous vine with large perennial root stock. Occasional on bare ground and climbing by tendrils among shrubs.

Euphorbiaceae

- Acalypha californica* Benth. Malacophyllous shrub or subshrub. Infrequent on south-facing slopes.
- Eremocarpus setigerus* (Hook.) Benth. Annual. Common roadside and old field weed.
- Euphorbia misera* Benth. Malacophyllous semi-succulent shrub. Frequent on south-facing slopes, rocky places, and beach cliffs.
- E. polycarpa* Benth. var. *polycarpa*. Herbaceous perennial. Fire successional species on granite. Frequent on open slopes. Apparently flowers the first year.
- E. spathulata* Lam. Annual. Infrequent in disturbed habitats.

Fabaceae

- Astragalus didymocarpus* H. & A. Annual. Grassy places.
- A. sanctorum* Barneby. Herbaceous perennial, known only from Banda Peak where it was discovered by Reid Moran.

- Astragalus trichopodus* (Nutt.) A. Gray var. *lonchus* (Jones) Barneby
[=*Astragalus trichopodus* ssp. *leucopsis* (T. & G.) Thorne]. Herbaceous perennial. Common, especially in disturbed areas.
- Lathyrus laetiflorus* Greene ssp. *glaber* C. L. Hitch. Herbaceous perennial vine. Common among shrubs in arroyos. Variable, especially in leaf characters; leaflets range from linear to oblong or elliptic. The subspecies is a transition-zone endemic.
- Lotus hamatus* Greene. Annual. Common.
- L. salsuginosus* Greene. Annual. Dry slopes.
- L.* cf. *strigosus* (Nutt. in T. & G.) Greene. Annual. (May be *L. subpinnatus* Lag.)
- L. watsonii* (Vasey & Rose) Greene. Common weak stemmed perennial. Transition-zone endemic. Usually growing in other shrubs. Similar to *L. scoparius* but with pedunculate umbels.
- Lupinus agardhianus* Heller. Annual.
- L. bicolor* Lindl. ssp. *microphyllus* (S. Wats.) D. Dunn. Annual.
- L. concinnus* J. G. Agardh. Annual.
- L. hirsutissimus* Benth. Annual.
- L. longifolius* (S. Wats.) Abrams. Herbaceous perennial, subshrub. Bluffs on north slope of the peninsula.
- L. sparsiflorus* Benth. Annual.
- L. truncatus* Nutt. ex H. & A. Annual.
- **Medicago polymorpha* L. Annual.
- **Melilotus indicus* (L.) All. Annual.
- **M. officinalis* (L.) Lam. Annual.
- Trifolium gracilentum* T. & G. Annual. Approaching *T. palmeri* Wats. of Santa Catalina, San Clemente, and Guadalupe Islands.
- T. tridentatum* Lindl. var. *aciculare* (Nutt.) McDer. Annual.
- Vicia exigua* Nutt. in T. & G. Annual.

Fagaceae

- Quercus dumosa* Nutt. Evergreen sclerophyll shrub. One local population growing on sandstone in a canyon on the north side of the peninsula west of La Joya with *Helianthemum scoparium*.

Gentianaceae

- Centaurium venustum* (A. Gray) Rob. Annual. Los Arbolitos.

Geraniaceae

- **Erodium cicutarium* (L.) L'Her. Annual weed. Common in disturbed habitats.
- **E. moschatum* (L.) L'Her. Annual weed. Common in disturbed habitats.

Hippocastanaceae

Aesculus parryi A. Gray. Summer-deciduous shrub. Common on gentle to steep slopes mostly with a northern exposure. This plant is leafless most of the year. Leaves emerge in late fall or early winter and wither in March or April when the flowers are produced (Mooney and Bartholomew, 1974).

Hydrophyllaceae

Emmenanthe penduliflora Benth. Annual.

Eucrypta chrysanthemifolia (Benth.) Greene. Annual.

Phacelia cicutaria Greene var. *hispida* (A. Gray) J. T. Howell. Robust annual. Relatively common, slopes and canyons.

P. distans Benth. Annual. Common on burns and gravelly slopes. Often growing in shrubs.

P. hirtuosa A. Gray. Annual. Transition-zone endemic. Closely related to *P. cedrosensis* Rose.

P. ixodes Kell. Viscid herbaceous to suffrutescent perennial. Probably flowering the first year. Occasional, rocky places. Transition zone and Baja California Islands including Todos Santos, Cedros, and San Martín. This species is close to *P. lyonii* Gray, endemic to San Clemente and Santa Catalina islands.

P. parryi Torr. Common on dry slopes and in burned areas.

Pholistoma racemosum (Nutt.) Const. Annual. Infrequent on moist slopes.

Lamiaceae

Hyptis emoryi Torr. A typical Sonoran Desert wash shrub that may occur or did occur at La Joya (*vide* Reid Moran). This species was reported from Punta Banda by Hastings et al. (1972) based on a specimen collected by C. F. Harbison (SD).

**Marrubium vulgare* L. Malacophyllous subshrub. Short-lived weedy perennial; common.

Salvia apiana Jeps. Malacophyllous shrub. Occasional on granitic soil on ridge of peninsula east of Los Arbolitos.

S. munzii Epl. Malacophyllous shrub. Common on benches and slopes, sometimes forming nearly pure stands. Transition-zone endemic.

Malvaceae

Malacothamnus fasciculatus (Nutt.) Greene. Malacophyllous shrub. Occasional in chaparral. Fruits extensively damaged by insect larvae.

**Malva parviflora* L. Annual weed.

Sphaeralcea fulva Greene. Locally common in sandy, disturbed soil as near Los Arbolitos. Transition-zone endemic.

Myrtaceae

**Eucalyptus camaldulensis* Denhardt. Evergreen tree. Occurs in an old grove at Los Arbolitos (whence the place name). Probably able to persist through interception of moisture from frequent fogs.

Nyctaginaceae

Mirabilis californica A. Gray. Malacophyllous subshrub. Variable, with some individuals \pm woody well above the base, others strictly herbaceous above perennial root. Common in open vegetation, mostly on south-facing slopes.

Oleaceae

Fraxinus trifoliata (Torr.) Lewis & Epl. (= *F. dipetala* H. & A. var. *trifoliata* Torr.). Winter-deciduous shrub to low tree. Common on north-facing slopes and canyon sides.

Onagraceae

Camissonia californica (Nutt. ex T. & G.) Raven (= *Eulobus californica* Nutt. ex T. & G.; *Oenothera leptocarpa* Greene). Annual. Los Arbolitos trail to beach and on north slope near tip.

C. robusta Raven. Annual. Common in disturbed habitats.

Clarkia epilobioides (Nutt.) Nels. & Macbr. Annual. Knoll north of Los Arbolitos, and on north slope near tip.

Oxalidaceae

Oxalis californica (Abrams) Kunth. Herbaceous perennial. Occasional in rocky openings in chaparral.

Papaveraceae

Eschscholzia californica Cham. Annual or herbaceous perennial.

Platystemon californicus Benth. Annual. Locally common on mesic slopes.

Stylomecon heterophylla (Benth.) G. Tayl. Annual. Locally common on mesic slopes.

Plantaginaceae

Plantago erecta Morris ssp. *erecta*. Annual. Dry open places.

Polemoniaceae

- Gilia angelensis* V. Grant. Annual. Common in grassy places.
Linanthus dianthiflorus (Benth.) Greene. Annual. Locally common on flats and gentle slopes.
Navarretia hamata Greene ssp. *leptantha* (Greene) Mason. Annual. Dry rocky slopes.

Polygonaceae

- Chorizanthe procumbens* Nutt. Annual. Dry open places.
Eriogonum fasciculatum Benth. ssp. *fasciculatum*. Needle-leaved semi-sclerophyllous shrub. Common on both sides of the peninsula. On steep, windswept, south-facing slopes it has a ground hugging form with tiny leaves; on the steep north-facing slopes of Banda Peak it is a robust, woody shrub.
E. grande Greene var. *testudinum* Reveal. Suffrutescent perennial. Transition-zone and insular endemic. Rocky cliffs near the ocean on both sides of the peninsula. Otherwise known from S. Todos Santos Island.
Pterostegia drymarioides F. & M. Weak, prostrate annual. Mostly in shady places associated with rocks.

Portulacaceae

- Calandrinia ciliata* (R. & P.) DC. var. *menziesii* (Hook.) Macbr. Annual. With herbaceous vegetation.
C. maritima Nutt. Succulent annual. In openings between shrubs on sandy or gravelly soils.
Claytonia perfoliata Donn [= *Montia perfoliata* (Donn) T. J. Howell]. Annual. In canyons and on vernal moist banks adjacent to Los Arbolitos. Both the varieties *parviflora* (Dougl.) J. T. Howell and *perfoliata* are present.

Primulaceae

- Dodecatheon clevelandii* Greene ssp. *clevelandii*. Herbaceous perennial. Relatively common on mesic slopes in chaparral.

Ranunculaceae

- Clematis pauciflora* Nutt. in T. & G. Herbaceous perennial vine. Occasional growing over chaparral shrubs.
Delphinium parryi A. Gray. Herbaceous perennial. Infrequent. Collected once on the north slope of Punta Banda Peak at ca. 100 m.

Resedaceae

- Oligomeris linifolia* (Vahl.) Macbr. Annual. Common.

Rhamnaceae

- Ceanothus spinosus* Nutt. Malacophyllous shrub. Rare on peninsula. Isolated plants in dense chaparral in arroyos on north side of peninsula.
- C. verrucosus* Nutt. Evergreen sclerophyllous shrub. Local in chaparral, occurring in dense stands often associated with *Adenostoma fasciculatum* on the north side of the peninsula. Transition-zone endemic.
- Rhamnus insula* Kell. Evergreen sclerophyllous shrub. Frequent on hillsides and in arroyos in chaparral. Transition-zone and insular endemic.

Rosaceae

- Adenostoma fasciculatum* H. & A. Evergreen sclerophyllous shrub. Locally dominant, occurring in nearly pure stands on the crests of certain hills along the peninsula, on gentle north-facing slopes on sandstone west of La Joya and on the north slope of Banda Peak. Associated with *Eriogonum fasciculatum*, *Cneoridium dumosum*, and *Ceanothus verrucosus*. Many stunted stands are exposed to fog or moisture-laden air and grow in shallow, rocky, apparently poor soils derived from sedimentary rock.
- Heteromeles arbutifolia* M. Roem. Evergreen sclerophyllous shrub. Occasional in chaparral on north-facing slopes and in arroyos.

Rubiaceae

- Galium angustifolium* Nutt. Subshrub; quite woody. Common among shrubs.
- G. nuttallii* A. Gray ssp. *nuttallii*. Suffruticose clamberer among shrubs.

Rutaceae

- Cneoridium dumosum* (Nutt.) Hook. f. Evergreen malacophyllous shrub. Frequent in open chaparral. Transition-zone endemic.
- Ptelea aptera* Parry. Winter-deciduous woody shrub. North-facing slopes in chaparral. Transition-zone endemic.

Salicaceae

- Salix lasiandra* Benth. Winter-deciduous tree. Several on sandstone in arroyo near La Joya.

Saxifragaceae

- Jepsonia parryi* (Torr.) Small. Herbaceous perennial. Shaded slopes and banks. Only a few individuals were observed until the spring

- of 1973, when hundreds were found. The corm-like rootstocks can clearly persist for several years without sending up leaves.
- Lithophragma affine* A. Gray ssp. *mixtum* R. L. Taylor. Herbaceous perennial. Uncommon; steep north-facing slopes or shaded banks.
- Ribes malvaceum* Sm. var. *viridifolium* Abrams. Evergreen malacophyllous shrub. Infrequent on north-facing slopes in chaparral.
- R. tortuosum* Benth. Malacophyllous shrub. Occasional in open chaparral or coastal sage scrub. Deciduous; with flowers appearing before leaves. Transition-zone and insular endemic.
- R. viburnifolium* A. Gray. Evergreen procumbent shrub. Common, mostly on north-facing slopes, among shrubs and in arroyos. Transition-zone and insular endemic.

Scrophulariaceae

- Antirrhinum nuttallianum* Benth. in DC. Annual. Among herbs and shrubs.
- Castilleja foliolosa* H. & A. Suffrutescent perennial root-hemiparasite. Infrequent in chaparral.
- C. jepsonii* Bacig. & Heckard. Herbaceous perennial root-hemiparasite. Frequent among shrubs.
- Collinsia heterophylla* Buist ex Grah. Annual. Vernal moist shaded banks.
- Cordylanthus orcuttianus* A. Gray. Annual root-hemiparasite. Flowers in late spring and summer. Usually occurs with herbaceous vegetation. Transition-zone endemic.
- Galvesia juncea* (Benth.) Ball. Stem-photosynthetic shrub. Infrequent in dry places, heavily browsed. Occurs in both viscid puberulent and glabrous, sometimes glaucous, forms. Transition-zone and insular endemic.
- Linaria canadensis* (L.) Dum-Cours. var. *texana* (Schelle) Penn. Grassy places with other herbs.
- Mimulus aurantiacus* Curt. ssp. *australis* (McMinn.) Munz. Malacophyllous shrub. Frequent on north-facing slopes and in arroyos.
- Orthocarpus purpurascens* Benth. Annual root-hemiparasite. Grassy places with other herbs.

Solanaceae

- Lycium brevipes* Benth. Woody shrub. Common, on alluvial soils and sandstone.
- L. californicum* Nutt. Leaf succulent shrub. Sea bluffs.
- Nicotiana clevelandii* A. Gray. Annual. In scattered populations mostly on flats or gentle slopes.
- **N. glauca* Grah. Malacophyllous shrub. Infrequent weed. Sometimes in dense stands.
- Physalis crassifolia* Benth. Perennial herb. On Punta Banda (*vide* Reid Moran).

- Physalis greenei* Vasey & Rose. Annual. Collected once in sandy bottom of deep arroyo on southwest side near tip.
- Solanum douglasii* Dunal. Weak malacophyllous subshrub. Disturbed habitats.
- S. xanti* A. Gray var. *intermedium* Parish. Malacophyllous subshrub. Principally in disturbed habitats.

Urticaceae

- Hesperocnide tenella* Torr. Annual. Occurs in patches on shaded, seasonally damp banks.

ANTHOPHYTA—MONOCOTYLEDONEAE

Agavaceae

- Agave shawii* Engelm. Rosette succulent. Common and conspicuous in rocky places, dry flats, and south-facing slopes.

Amaryllidaceae

- Allium praecox* Bdg. Herbaceous perennial. Infrequent on north-facing grassy slopes.
- Dichelostemma pulchella* (Salisb.) Heller. [= *Brodiaea pulchella* (Salisb.) Greene]. Herbaceous perennial. Common on grassy slopes and among shrubs.

Liliaceae

- Calochortus splendens* Dougl. ex Benth. Herbaceous perennial. Uncommon on flats and gentle slopes in heavy soils.
- Zygadenus fremontii* Torr. Herbaceous perennial. Rare on peninsula, north slope of Banda Peak at ca. 120 m.

Poaceae

- Agrostis* sp. Perennial. Represented by a single sterile specimen.
- **Avena barbata* Brot. Annual.
- Bothriochloa barbinodis* (Laq.) Herter. Perennial.
- **Bromus arenarius* Labill. Annual.
- **B. mollis* L. (= *B. hordeaceus* L.) Annual.
- **B. rubens* L. Annual.
- B. trinii* Desv. Annual.
- **Cynodon dactylon* (L.) Pers. Perennial. Weed at La Joya.
- Elymus condensatus* Presl. Semi-woody perennial. Frequent on arroyo banks and steep north-facing slopes in chaparral.
- **Hordeum leporinum* Link. Annual.
- **Lamarckia aurea* (L.) Moench. Annual. Waste places as at Los Arbolitos.

Melica frutescens Scribn. Herbaceous perennial. Common on open slopes.

M. imperfecta Trin. Herbaceous perennial.

Monanthochloë littoralis Engelm. Perennial. Old fields near Los Arbolitos.

Muhlenbergia microsperma (DC.) Kunth. Annual.

Poa scabrella (Thurb.) Benth. ex Vasey. Herbaceous perennial. Uncommon, hillsides among shrubs.

**Schismus barbatus* (L.) Thell. Annual.

**Setaria verticillata* (L.) Beauv. Annual.

Stipa cernua Steb. & Love. Herbaceous perennial.

S. coronata Thurb. in Wats. var. *depauperata* (Jones) Hitchc. Herbaceous perennial.

S. pulchra Hitchc. Herbaceous perennial.

S. diegoensis Swall. Herbaceous perennial. Upper slopes of Banda Peak and near La Bufadora.

**Vulpia megalura* (Nutt.) Rydb. Annual.

**V. myuros* (L.) K. C. Gmelin. Annual.

V. octoflora (Walt.) Rydb. Annual.

Zosteraceae

Phyllospadix scouleri Hook. Herbaceous perennial. Surf-beaten rocky shores.

ACKNOWLEDGMENTS

We thank Reid Moran, Peter Raven, Lincoln Constance, Ralph Philbrick, and John Thomas for their assistance. Lyman Benson, Edwin A. Phillips, and Robert F. Thorne graciously made their time, facilities, and specimens available while one of us (T.W.M.) was teaching at Pomona College. We gratefully acknowledge the field help of numerous colleagues, students, and friends.

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(Accepted 16 Jan 1979.)